

# PATENT SPECIFICATION

636,290



Date of Application and filing Complete Specification: Jan. 7, 1948.

No. 553/48.

Application made in Sweden on Jan. 9, 1947.

Complete Specification published: April 26, 1950.

Index at acceptance:—Class 110(i), C2b(3a1: 5), C2f1, D2(b1: g1).

## COMPLETE SPECIFICATION

### Improvements in Diffusers for Centrifugal Compressors

I, ALF LYSHOLM, of Viktor Rydbergsgatan 33, Gothenburg, Sweden, a Swedish subject, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to diffusers for centrifugal compressors.

According to the invention such a diffuser comprises guide vanes with inlet edges located obliquely with respect to the direction of flow, and guide vanes having inlet edges at right angles to said direction, the last-named guide vanes being arranged in series after the first-named guide vanes.

The first-named guide vanes may extend radially and the last-named guide vanes axially, or *vice versa*.

In the accompanying drawings, there are illustrated several embodiments of the invention.

Figure 1 shows two guide vanes located in the outlet from a centrifugal compressor, one of said vanes being adjustable.

Figure 2 is a sectional view of another embodiment.

Figure 3 is a sectional view of a diffuser between two stages of a multi-stage compressor.

Figures 4, 5 and 6 illustrate three different shapes of blade inlet edges.

In Figure 1, numeral 1 denotes the diffuser of a centrifugal compressor. In the diffuser, there is provided a guide vane 2 which, in the example shown, is adjustable by means of a gear wheel 3. The inlet edge 4 of the guide vane is broken, and both ends of the inlet edge are located obliquely with respect to the direction of flow of the working fluid. A further guide vane 12 has a straight inlet edge 12a.

In the embodiment illustrated in Figure 2, the inlet edge 6 of the moving blade 5 has an approximately saw-like shape. The edge portion 6a located nearest the periphery is inclined at an angle of 45°

with respect to the direction of flow, the next portion 6b is deviated about 50° from the direction of flow, whereas the innermost portion 6c is continuously curved and at the hub 5a is located substantially at right angles to the direction of flow. The shape described is due to the fact that the risk of compression shocks is greatest at the radially outermost portion of the blade where the relative velocity is a maximum.

In the embodiment according to Fig. 2, a fixed guide vane 7 is provided in the diffuser portion 1, said vane being located at an angle of approximately 45° with respect to the direction of flow. In this compressor, too, there is provided a further guide vane 17 having a straight inlet edge 17a at right angles to the direction of flow.

Figure 3 is a sectional view of a diffuser between two stages of a two-stage or multi-stage centrifugal compressor, one moving blade of which is indicated at 5b. In the diffuser 10, there is provided a guide vane 11 which extends obliquely outwards from the inner wall of the diffuser in the direction of flow of the working fluid and is located substantially 45° with respect to said direction. Due to the provision of said guide vane, it is possible to reduce the diameter of the diffuser, as the velocity of the fluid need not be reduced so much as in the case of inlet edges located at right angles to the direction of flow. After the guide vane 11, as viewed in the direction of flow, there is provided a guide vane 21 having an inlet edge 21a at right angles to the direction of flow.

In the embodiments according to Figures 1 to 3 there are provided, as indicated above, guide vanes 2, 7 and 11, respectively, having oblique inlet edges as well as additional guide vanes 12, 17 and 21, respectively, having inlet edges at right angles to the direction of flow. As will be seen from the drawing, the arrangement may be such that the vanes having oblique inlet edges extend either in axial direction, Figures 1 and 2, or in radial direction,

Figure 3, whereas the vanes having their inlet edges located at right angles to the direction of flow extend radially or axially, respectively. The type of blades to be used is dependent upon the conditions under which the compressor is desired to be operated.

In Figures 4 to 6, there are shown three different shapes of inlet edges of blades 22, 23 and 24, respectively, for centrifugal compressors having the common feature that the deviation of the inlet edges 22a, 23a and 24a, respectively, is a maximum at the outermost portion of the blades. At the inner portions of the blades, the angle between the edge and the direction of flow is substantially 90°, whereas said angle is substantially 45° at the outer blade portions.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:—

1. A diffuser for centrifugal compressors

having guide vanes with inlet edges located obliquely with respect to the direction of flow, and guide vanes having inlet edges at right angles to said direction, the last-named guide vanes being arranged in series after the first-named guide vanes.

2. A diffuser according to claim 1, in which the first-named guide vanes extend radially and the last-named guide vanes extend axially.

3. A diffuser according to claim 1, in which the first-named guide vanes extend axially and the last-named guide vanes extend radially.

4. A diffuser for centrifugal compressors substantially as described with reference to any of Figures 1 to 6 of the accompanying drawings.

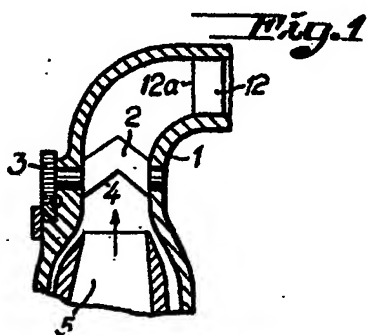
Dated this 7th day of January, 1948.

ALF LYSBOLM,

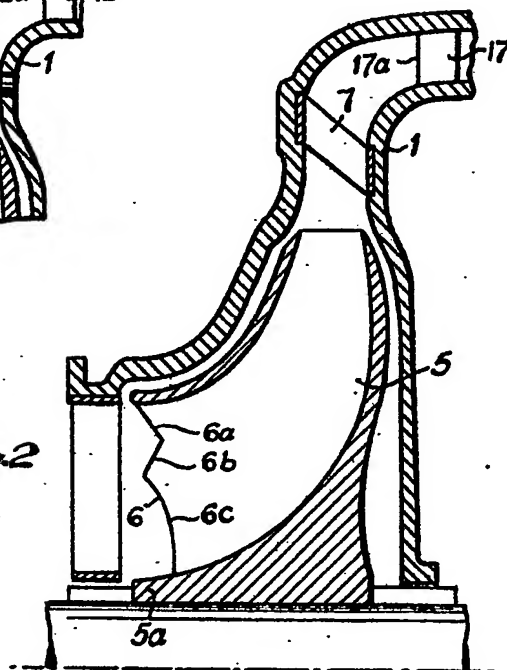
Per: Boulton, Wade & Tennant,  
111/112, Hatton Garden, London, E.C.1,  
Chartered Patent Agents.

Leamington Spa: Printed for His Majesty's Stationery Office, by the Courier Press.—1950.  
Published at The Patent Office, 25, Southampton Buildings, London, W.C.2, from which copies, price 2s. 0d. each (inland) 2s. 1d. (abroad) may be obtained.

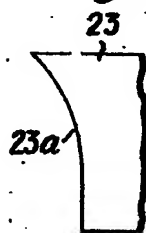
[This Drawing is a reproduction of the Original on a reduced scale.]



**Fig. 2**



**Fig. 5.**



**Fig. 3**

**Fig. 4.**

**Fig. 6.**

